

Amendments to the Drawings:

The drawing sheet attached in connection with the above-identified application containing Figures 2a-3 are being presented as a new formal drawing sheet to be substituted for the previously submitted drawing sheet. The drawing Figure 3 has been amended.

The specific change which has been made to Figure 3 is that the legend "Prior Art" has been added to the figure.

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 1-15 are pending in this application. Claim 1 is an independent claim. Claims 1-13 have been amended. Support for the amended claims can be found at least on pages 8-11 of the specification.

This amendment changes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claims remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-15 are now pending in this application.

Title

In the Office Action, the title was objected to as not being descriptive. In response, Applicants amend the title to read "MAGNETIC DISPLACEMENT RULER." Accordingly, Applicants respectfully request reconsideration and that the objection be withdrawn.

Drawings

In the Office Action, FIG. 3 was objected to for not being labeled "prior art." In response, Applicants amend FIG. 3 so that it is now labeled "Prior Art." Accordingly, Applicants respectfully request reconsideration and that the objection be withdrawn.

Claim Objections

Claim 8 was objected to under 37 CFR 1.75(c) as being in improper form. Claims 7, 9-10 and 12 were objected to due to informalities. In response, Applicants amend claims 7-10 and 12 to correct the informalities. Thus, Applicants respectfully request reconsideration and that the objections be withdrawn.

Prior Art Rejections

Claims 1-2, 5, 7 and 9 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,332,278 (“Bezing et al.”). In response, without agreeing or acquiescing to the rejection, Applicants amend claims 1-13 to further define the invention. Further, Applicants traverse the rejections for the reasons set forth below.

Independent claim 1 as amended is directed to a magnetic displacement measuring device. The claimed device includes a ruler body, a vernier, a magnetic main ruler fixed to the ruler body, a secondary ruler fixed on the vernier comprising a magnetic sensor and a measurement circuit. Claim 1 as amended recites that the “measurement circuit comprises at least two measurement bridges which are composed of giant magnetoresistances and are electrically connected with an AC power supply, such that the measurement bridges receive AC power as input.” Since an AC power supply is used to provide an input signal in the present invention, the displacement quantity or movement distance is measured using the change of the phase of the signal outputted by the measurement bridges. The change in phase of a signal is less susceptible to outside interference than the change in amplitude of a signal. Accordingly, by using the change in phase, the claimed device is more accurate than a device having a DC input signal because it is less susceptible to interference.

Further, both the magnetic sensor and measurement bridges of claim 1 are composed of giant magnetoresistances. Giant magnetoresistances are formed by multiple layers of magnetic film coupled together in a sandwich structure. Employing the giant magnetoresistances improves the magnetic sensor’s and measurement bridges’ sensitivity to a magnetic field. The sensitivity of a giant magnetoresistance is one order higher than that of a general magnetoresistance made of a single film structure. Accordingly, the claimed device can detect a slight change of the magnetic field and thus ensure that a slight displacement of the vernier is detected.

In contrast, Bezing et al. is directed to a portable precision electronic caliper. Bezing et al. does not disclose, teach or suggest having two measurement bridges composed of giant magnetoresistances that are electrically connected with an AC power supply as claimed in amended claim 1. Instead, the device disclosed in Bezing et al. is configured to

use DC power as an input signal. (See Col. 4, lines 8-10, “The means 11 include furthermore self-powered electricity supply means, being a battery 110...”.) Instead of a phase shift being caused by AC power, the electrodes of each bridge in the device disclosed in Bezing et al. are phase shifted 90° due to their physical orientation relative to each other. (See FIG. 4.) Thus, since Bezing et al. uses a DC power supply as input, its displacement measure will be obtained by detecting the change in amplitude of the device’s output signals. These output signals (based on changes in amplitude) are easily affected by outside interference. Accordingly, the device disclosed in Bezing et al. may be less accurate and reliable than the claimed invention.

Further, Bezing et al. does not disclose, teach or suggest a measurement displacement device having a magnetic sensor or a measurement bridge composed of giant magnetoresistances as claimed in amended claim 1. In contrast, Bezing et al. uses single layer anisotropic magnetic material (AMR). Therefore, the device in Bezing et al. is less sensitive to changes in a magnetic field than the claimed invention.

Accordingly, for the reasons set forth above, Applicant respectfully submits that Bezing et al. does not disclose, teach or suggest each and every element of amended claim 1. Further, claims 2-15 depend from claim 1 and are allowable for at least that reasons without regard to further patentable limitations cited therein. For example, Bezing et al. does not disclose, teach or suggest a magnetic main ruler provided with magnetic grids that form a grid-type magnetic field with a permanent magnet, or are magnetized directly to form a grid-type magnetic field as claimed in claim 2. Thus, for the reasons set forth above, Applicant respectfully requests reconsideration of claims 1-15 and that the rejection be withdrawn.

Claim Rejections under 35 U.S.C. § 103

Claims 3-4, 6-7 and 9-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Bezing et al. in view of U.S. Patent No. 5,313,186 (“Schuhl et al.”).

As stated above, independent claim 1 has been amended to further define the invention. Claims 3-4, 6-7 and 9-15 depend from claim 1 and are therefore allowable without regard to further patentable limitations cited therein. Schuhl et al. discloses a multilayer

structure with giant magnetoresistance. However, in light of newly amended claim 1, Schuhl et al. fails to cure the deficiencies of Bezing et al. Further, Applicant submits that Schuhl et al. simply teaches how to make a sensor for detecting a magnetic field. However, Schuhl et al. does not disclose, teach or suggest "measurement bridges which are composed of giant magnetoresistances" configured to measure displacement as claimed in amended independent claim 1. Accordingly, Applicant respectfully requests that the rejection be withdrawn and claims 3-4, 6-7 and 9-15 be allowed.

Conclusion


Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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